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## (54) BURNER HOUSING

(71) We, DEUTSCHE GOLD - UND SILBER-SCHEIDENSTALT VORMALS ROESSLER, a body corporate organised under the laws of Germany, of 9 Weissfrauenstrasse 6, Frankfurt(main) 1, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a tubular burner housing for gas-discharge lamps of light-permeable ceramic material, comprising at one or both ends of the housing a closure member of the same material for accommodating the electrode bushing.

Tubes of compactly sintered polycrystalline aluminium oxide or magnesium oxide/ aluminium oxide spinel with high permeability to light are used as burner housings in the production of high-pressure sodium vapour lamps because quartz glass (used in other cases) is not sufficiently corrosion-resistant to a gas atmosphere containing sodium vapour at the working temperature of from 700 to 1500°C.

One serious problem affecting the use of discharge vessels of ceramic materials of this kind is the vacuum-tight closure of the lamp vessels. Several methods are available for this purpose. According to German Anslegeschrift 1,218,924, for example, metal end caps are soldered with hard solder onto the suitably metallised ceramic parts. In another process described in U.S. Patent Specification 3,428,846, metal end caps are joined to the ceramic housing with active solders. According to British Patent Specification 1,015,506, this joint is made with glass solders. It is also known to use ceramic plugs which are either subsequently cemented in with a suitable glass solder (German Offenlegungsschrift 1,471,379 or inserted after forming of the ceramic tube and then sintered into it (German Offenlegungsschrift 1,639,086).

One feature common to all these pro-

cesses is that closure of the discharge vessels involves a number of individual stops either during production of the ceramic housing itself or during subsequent assembly of the sodium vapour lamp.

In addition, several additional joints are formed which can give rise to leaks, thus reducing the reliability of the lamp in operation. The same also applies as regards sintered-in ceramic plugs which, due to the well-known difficulties involved in finishing oxide ceramics, can only be made gas-tight by an additional layer of glass solder subsequently applied to the joint between tube and plug.

The present invention provides a tubular light-permeable ceramic burner housing for a gas-discharge lamp which is provided at one or both ends with a closure member of the same light-permeable ceramic material for accommodating an electrode bushing which closure member is sintered with the housing as a single homogeneous piece.

In one preferred embodiment of the invention, the junction between the inner surface of the housing and the closure member is rounded off. The closure member can have a central bore for the electrode bushing. The burner housing according to the invention preferably consists of polycrystalline transparent aluminium oxide with a purity of at least 99.5%.

Accordingly, there is no need for any additional process stages for inserting the closure member. A secure gastight joint between the tube and the closure member is obtained. In addition, rounding off the junction between tube and closure member provides for favourable mechanical stability by avoiding shear action which is important on account of the heavy stressing imposed by the mechanical stresses attributable to fluctuations in temperature when the lamp is in operation. This configuration is also favourable in regard to the corrosive effect of the discharge atmosphere.

In one particular embodiment, the burner housing according to the invention com-

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prises homogeneously sintered closure members at both ends. Bores in the closure members are used to accommodate the electrode bushings during assembly of the discharge lamp. Hitherto difficulties have been encountered in the production of burner housings of the kind in question because a steel core normally used for pressing can no longer be removed from the pressed material. According to the invention, these difficulties can be obviated by the insertion, known *per se* from German Anslegeschrift 1,529,836, of a core of a material which is completely burnt under the effect of heat, for which purpose the core is made hollow and carries an insert, preferably of steel, which can be removed after pressing.

Accordingly, the present invention also provides a process for producing a burner housing as described above with closure members at both ends integral with the housing for accommodating electrode bushings which comprises forming a ceramic material around a core, preferably by isostatic pressing, and sintering the ceramic material, the core comprising an inner mandrel, preferably consisting of metal, which is removed before sintering and an outer mandrel composed of a material which is completely decomposed on heating, preferably a plastics material.

In a preferred procedure a ceramic powder is pressed, preferably by isostatic pressing, in a mould around the core which comprises a centrally arranged outer mandrel of circular cross-section with a cylindrical bore, the outer surface of the outer mandrel being adapted to provide the required internal dimensions of the burner housing and an inner mandrel of circular cross-section, preferably of metal, removable fitted into the outer mandrel, the cross-section of the inner mandrel being no greater than the cross-section of the electrode bushing and the inner mandrel projecting from the outer mandrel at both ends and engaging, after a distance corresponding to the required length of the closure member, centring openings at both ends of the mould, after pressing, the pressed ceramic powder and the inner and outer mandrels are removed from the mould, the inner mandrel is withdrawn from the outer mandrel, the pressed ceramic powder and the outer mandrel is heated until the outer mandrel has been completely decomposed and the pressed ceramic powder is sintered.

Preferably the outer mandrel is made of a material completely decomposed by heating in the presence of an oxygen-containing gas and heating of the outer mandrel and the pressed ceramic powder is carried out in a stream of air.

It is of advantage to use an outer mandrel with an outer surface rounded off at its

ends to provide a rounded off junction between the inner surface of the housing and the closure member. Suitable materials decomposing completely under the effect of heat which can be used for the outer mandrel include plastics such as polymethyl methacrylate or polystyrene.

The invention is described in more detail in the following with reference to the accompanying drawings, in which:

Figure 1 illustrates a burner housing according to the invention with closure members at both ends.

Figure 2 diagrammatically illustrates the mould of an isostatic press for producing burner housings provided at both ends with closure members.

According to Figure 1, a tubular ceramic burner housing 11 comprises at each end a closure member 12 which at its centre has a bore 13 for accommodating an electrode bushing.

To produce a burner housing with closure members at both ends, a plastics mandrel 4 of polystyrene with a steel mandrel 5 inserted into it is arranged in the isostatic mould whose most important components are shown in Figure 2, and which consists of an outer supporting tube 1, a flexible die 2 and a bottom plug 3. The steel mandrel 5 projects from the plastics mandrel 4 and at its end 6 engages in a centring opening 7 situated in the bottom plug 3. The exposed part 8 of the steel mandrel corresponds to the length of that part of the burner housing to be produced which has a reduced cross-section to accommodate the electrode bushing. Dry aluminium oxide powder pretreated with polyvinyl alcohol as binder is then introduced into the space 9 between the flexible die 2 and the mandrel arrangement 4 and 5. The mould is closed by a closure 10 and introduced into a conventional hydrostatic press (not shown) in which it is subjected to a pressure of around 1,000 atms.

On completion of the pressing operation, the pressing is removed from the mould as follows: the closure 10 is removed, after which the supporting tube 1 and die 2 are removed together from the bottom plug 3, the mandrel arrangement 4 and 5, and the pressing. The bottom plug 3 is then withdrawn together with the steel mandrel 5 from the pressing and the plastics mandrel 4. The plastics mandrel 4 is left temporarily in the aluminium oxide pressing. This is then heated in a stream of air, as a result of which the binder and the plastics core are completely removed. This is followed by sintering of the pressing into transparent aluminium oxide by known methods, i.e. by heating at a temperature above 1800°C in a stream of hydrogen.

## WHAT WE CLAIM IS:—

1. A tubular light-permeable ceramic burner housing for a gas-discharge lamp which is provided at one or both ends with a closure member of the same light-permeable ceramic material for accommodating an electrode bushing which closure member is sintered with the housing as a single homogeneous piece. 50

2. A burner housing as claimed in claim 1, wherein the junction between the inner surface of the housing and the closure member is rounded off. 55

3. A burner housing as claimed in claim 1 or 2, wherein the closure member has a central bore for the electrode bushing. 60

4. A burner housing as claimed in any of claims 1 to 3 consisting of polycrystalline transparent aluminium oxide with a purity of at least 99.5%. 65

5. A burner housing substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings. 70

6. A process for producing a burner housing as claimed in claim 1 with closure members at both ends integral with the housing for accommodating electrode bushings which comprises forming a ceramic material around a core and sintering the ceramic material, the core comprising an inner mandrel which is removed before sintering and an outer mandrel composed of a material which is completely decomposed on heating. 75

7. A process as claimed in claim 6 wherein forming is carried out by isostatic pressing. 80

8. A process as claimed in claim 6 or 7 wherein the inner mandrel is made of metal. 85

9. A process as claimed in any of claims 6 to 8 wherein the outer mandrel is made of a plastics material. 90

10. A process as claimed in any of claims 6 to 9 wherein a ceramic powder is pressed in a mould around the core which comprises a centrally arranged outer mandrel of circular cross-section with a cylindrical bore, the outer surface of the outer mandrel being adapted to provide the required internal dimensions of the burner housing, and an inner mandrel of circular cross-section removeably fitted into the outer mandrel, the cross-section of the inner mandrel being no greater than the cross-section of the electrode bushing and the inner mandrel projecting from the outer mandrel at both ends and engaging, after a distance corresponding to the required length of the closure member, centring openings at both ends of the mould, after pressing, the pressed ceramic powder and the inner and outer mandrels are removed from the mould, the inner mandrel is withdrawn from the outer mandrel, the pressed ceramic powder and the outer mandrel are heated until the outer mandrel has been completely decomposed and the pressed ceramic powder is sintered. 14.

11. A process as claimed in any of claims 6 to 10 wherein the outer mandrel is composed of a material which is decomposed by heating in the presence of an oxygen containing gas and heating takes place in a stream of air. 12. A process as claimed in any of claims 6 to 11 wherein the outer mandrel has an outer surface which is rounded off at its ends to provide a rounded off junction between the inner surface of the housing and the closure member. 13. A process as claimed in any of claims 6 to 12 wherein the outer mandrel is made of polymethyl methacrylate or polystyrene. 14. A process for the production of a burner housing substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings. 15. A burner housing when prepared by a process as claimed in any of claims 6 to 14.

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of  
the Original on a reduced scale*

Fig. 1.

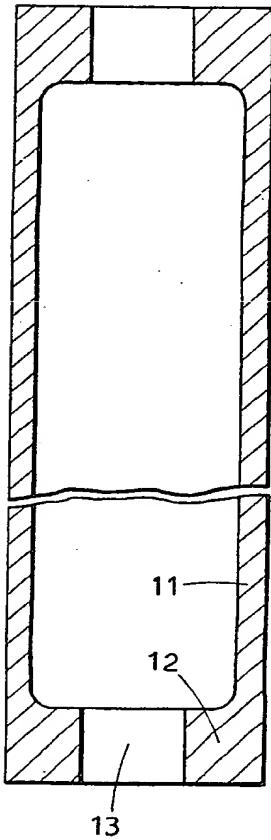


Fig. 2.

